

## **Stem-cells from menstrual blood in Twitter: paper attention on social media**

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### **ABSTRACT**

Since 2007 research results on stem cells from menstrual blood - the so-called MenSCs (Menstrual blood derived stem cells) - began to be published. Although less prestigious and more marginalized, MenSCs were characterized and compared to the potential of embryonic stem cells and medullary mesenchymal cells. Although menstrual blood is easy to obtain and accessible by less invasive procedures than those for obtaining embryonic cells or bone marrow, the use of this type of stem cells is still incipient and is considered taboo in the academic environment. Most research in this line is done by female researchers and access to research funding seems to be much more restricted to that of stem cells from other sources. This paper proposes an analysis of the dissemination of scientific articles on menstrual blood stem cells on Twitter. We framed our paper under the hypothesis: Despite the proven scientific quality of menstrual blood stem cells, research and science output on this tissue generate primarily interest from women (academic and non-specialist), on the one hand, and science communication of those papers in general cause bias and / or negative comments, on the other hand. We built our sample from the PubMed database by searching for keywords that refer to the type of stem cells and tissues of origin in the title and abstract of papers published from 2008 to 2019. There were no mentions on social media for 39.6% of the papers and the ones that were mentioned got an average of 2.5 tweets each. Only 7 papers got 10 or more tweets which may suggest lack of interest of the scientific community in MenSCs and/or lack of effort from authors to share it on social media. Comments were present in 37% of our samples and women and groups made mostly positive and neutral comments, while men made all the negative ones. This brief analysis reinforces Twitter as a means to disseminate information more than to start up social debate. It also points to little social interest, in Twitter, to these potent cells with promising future treatments. Scholars working with MenSCs should plan communication efforts on social media as a way to attract more visibility, interest and relevance on the public sphere.

**Keywords:** Altmetrics, gender, menstrual blood, stem cells, Twitter.

## INTRODUCTION

The use of stem cells in research was popularized after the successful cloning of Dolly the sheep by the Roslin Institute in Scotland in 1997. Since then, science output on the therapeutic use of stem cells for research have multiplied with application in the health sciences, focused mainly in human embryonic tissues. Due to the (bio)ethical issues posed for research with embryos, another front of research began to be drawn from the use of adult tissues, with already differentiated cells, but that showed differentiation potentials: mesenchymal stromal cells. The tissues most commonly used are bone marrow and umbilical cord blood, but also tissues derived from pregnancies (placenta, amniotic fluid, Wharton jelly from the umbilical cord) have been used.

However, since 2007 research results on stem cells from menstrual blood - the so-called MenSCs (Menstrual blood derived stem cells) - began to be published (Manica et al. 2018). Although less prestigious and more marginalized, MenSCs were characterized and compared to the potential of embryonic stem cells and medullary mesenchymal cells. Researchers concluded that their reprogramming time - necessary to start generating cells from other human tissues - was faster than other stem cells, between 7 and 15 days, and efficient (Rodrigues et al. 2012). Access to menstrual blood was also shown to be easy and available, as it is a type of material that is widely discarded, and accessible by less invasive procedures than those for obtaining embryonic cells or marrow.

Studies have shown marginality of researchers who work with MenSCs' cells. As MenSCs have a strong gender link it prevents them from being used as model-cells in future treatments (Manica, 2019; Manica, Goldenberg & Asensi, 2018):

Despite producing excellent results, MenSCs still occupy, in the research universe of LCCM, a secondary or marginal position in relation to other cell sources. Among the cells that are used with a privileged place are those of bone marrow, adipose tissue, placenta, umbilical cord and tissues derived from pregnancy and even pulp of children's teeth (Manica 2019 p.18).

The use of stem cells from menstrual blood is still incipient and is considered taboo in the academic environment. Most research in this line is done by female researchers and access to research funding seems to be much more restricted to that of stem cells from other sources (Manica et al 2018).

An analysis of papers about different mesenchymal cells from 2008 to 2018 collected in PubMed clearly shows that only a tiny portion was dedicated to MenSCs, even though their scientific quality and superiority has been demonstrated. Only 0.2% of a total of 81,289 papers were about menstrual blood mesenchymal cells, while 66% were using bone marrow, 8.6% umbilical cord, 8.7% placenta, 8.3% dental pulp, 6.3% endometrium and 1.7% to amniotic fluid (Manica, 2019).

Another interesting result is a gender gaze into first and last, corresponding authors. Manica (2019) has identified a greater presence of women (58.6%) as first authors, and men as the main corresponding authors (69.2%) of papers about menstrual mesenchymal cells<sup>1</sup>. Thelwall and Nevil (2019) have shown the proportion of women as first authors is higher (between 44.8% and 40.3%) in fields of genetics, cell and molecular biology, and molecular medicine, for example, when compared to the proportion among last authors in the same fields: ranging from 31.8% to 24.7%.

## **Objective**

We propose an analysis of the dissemination of articles on menstrual blood stem cells on Twitter, a social network used by 339,5 million Internet users worldwide (Statista, 2019), but one of the most searched in altmetrics (Haustein, 2018) and used professionally by academics (Noorden, 2014; Haustein, 2018). Twitter data allows a more complete analysis of information exchange on user networks, since the vast majority of posts are public, unlike what happens with Facebook.

This paper is framed upon the following hypothesis: Despite the proven scientific quality of menstrual blood stem cells, research and science output on this tissue generate primarily interest from women (academic and non-specialist), on the one hand, and science communication of those papers in general cause bias and / or negative comments, on the other hand.

## **Methods**

We built our sample from the PubMed database, which brings together science papers in the Biomedical field using the keywords that refer to the type of stem cells and tissues of origin: human AND OR mesenchymal OR stromal OR stem cells AND bone marrow OR umbilical cord OR Wharton jelly OR adipocyte OR placenta OR dental pulp OR endometrium OR amniotic fluid OR menstrual blood. The search was done between the years 2008 to 2019, in the fields title and abstract. From the

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<sup>1</sup> In this sample 30 authors from China and Japan are still under investigation of gender.

identified articles, we selected PubMed identities (pubmed ids) and DOIs to identify and track their disclosure on Twitter, through the altmetric data provider Altmetric.com.

As Altmetric.com could not provide all tweets from our sample without subscribing to it. Therefore, we have manually collected 105 tweets from 16 papers, including 7 that received more than 10 tweets and 10 that received AAS equal or higher than 10. Only 4 tweets per paper (64) were accessible at Altmetric.com, the remaining ones (41) were tracked on Twitter by their title.

## **Results**

Preliminary results identified 81,374 articles, of which the smallest proportion, 201 articles (0.2%) deal with menstrual blood, while the majority refer to the bone marrow (66%), placenta (8.6%) and the umbilical cord (8.6%). After removing duplicates, we selected a corpus of 150 papers, which are directly related to the use of menstrual blood for the production of mesenchymal cells for research in the areas of cell therapy, regenerative medicine and bioengineering.

There were no mentions on social media for 41.3% of the papers and a total 535 mentions, with an average of 6.1 mentions per paper; a total of 384 tweets about the papers, with an average of 4.4 tweets per paper, higher than the 3.9 average tweets per paper about Dentistry (Kolahi et al. 2019). Only 12.7% (19) of papers received more tweets than the average and only 7 papers (4.7%) got 10 or more tweets.

As for the Google Scholar Citation, the 150 papers received a total of 6,042 citations or 40.28 per paper on average, 24% (almost a quarter) got more citations than the average. Despite high citations to papers in our sample, only 5 papers (3.3%) got both Google Scholar Citations and Altmetric Attention Score above the average (Figure 1). As authors have claimed, papers' citations among scholars (GCS) are different from social attention (AAS).

Geolocation was present in 61.4% of tweets, quite similar to other analysis (Robillard et al. 2015) that found from 65% and 63% in papers about stem cells. Although the majority of tweets related to stem cells are usually from the US and the UK (Robillard et al. 2015, Kolahi et al. 2019), our sample was mostly from the US and with the same numbers from the UK, Brazil and France.

Tweets were mostly retweets (RT) or just article titles and its link summing up 65.7% of the sample, while 34.3% included comments. Among the comments women were more present (48.6%), followed by men (25.7%), groups (14.3%) and others (11.4%) - not possible to infer.

The Twitter accounts were analysed considering gender defined in the bios/pictures: 30.5% of tweets belong to women, the same amount to groups, 22% to men, 10.5% to unknown gender, 5.7% to bots, 1.9% to bi (either bisexual or non-binary).

When we analysed the 36 comments, they were mostly positive (52.8%), followed by neutral (33.3%) and negative (13.9%) similar to what other analysis of stem cell tweets have found (Kamenova et al. 2014, Robillard et al., 2015), and almost non critical. The only exception is the analysis of Adam and colleagues (2011), that have investigated the Stem Cells Advancement Act and found tweets quite balanced in favor and contrary, and a minority that were neutral.

## **Discussion**

Twitter has been used to disseminate papers about MenSCs, although 41.3% received no mention on social media. Our results have shown that papers about mesenchymal cells from menstrual blood have received more scholar attention than social, even though papers have important requirements to attract social interest on social media: medicine and health, gender issues, controversial subjects.

34.3% of papers of our sample received comments, mostly from women (48.6%) and they tend to include a conversation not only between scholars but also with feminists and non-scholars, which may point to a gender interest topic.

Our results confirm that papers about MenSCs are of greatest interest to women, as they were the majority of tweet authors (30.5%) and comments (48.6%). Groups were also present as important disseminators of papers. Groups tweeted comments 100% positive about MenSCs, partly because they were mostly linked to science laboratories or to feminist issues. Men who tweeted comments would be more neutral or negative; and women, on the contrary, would be mostly positive and neutral. We have also noticed that women were more engaged, positive and the debate surpassed scholar's walls, since many women profiles were unrelated to science. Therefore, our first hypothesis was confirmed. Another interesting result is that all 4 negative tweets were from Twitter users who are either scientists,

doctors or science students that question the potential uses of MenSCs. So our second hypothesis proved wrong since negative comments were a minority.

This brief analysis reinforces Twitter as a means to disseminate information more than to start up a conversation, a social debate. It also points to little social interest, in Twitter, to these potent cells with promising future treatments. Therefore, scholars working with MenSCs should better plan communication efforts on social media as a way to attract more visibility, interest and relevance on the public sphere and, therefore, to contribute to a shift in the marginal position menstrual mesenchymal cells still hold. Involving women scientists, feminists and women influencers in science communication, efforts on Twitter sound as a good starting point to improve MenSCs' visibility.

### **Limitations of this work**

The limited number of Tweets analysed cannot be generalized. But as they have been collected from articles with more tweets and higher AAS, they might have provided a good sample.

### **Future Work**

This paper may contribute to understanding how science communication of papers happens in this field of study, in order to design communication strategies that modify the public and academic understanding of the use of menstrual blood for stem cell research.

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